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MONTANA MILL RESIDUE ASSESSMENT AND SIMULATION SYSTEM

USER'S GUIDE

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MONTANA MILL RESIDUE ASSESSMENT AND SIMULATION SYSTEM

--USER'S GUIDE--

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Introduction

The *Montana Mill Residue Assessment and Simulation System* allows a user to estimate the volume of mill residue utilized and unutilized in Montana based on various assumptions related to supply, production, and use. The program's output is designed to indicate the volume of sawmill residue which is presently not committed to use by county or county group. Similar information regarding plywood residue is included for the state.

Section 1, "A Note on Mill Residue," defines mill residue and describes the source and use of mill residue in Montana. Section 2, "Preparing to Use the Program," provides instructions for installing and loading the program. Section 3, "Using the Program," introduces the important features of the program. The last section provides an interpretation of the "simulation results."

1. A Note on Mill Residue

1.1 Definition

Mill residue is a general term used to describe the portion of timber delivered to a processing plant that does not become part of the final primary product. For example, all wood fiber delivered to a sawmill that is not part of the lumber produced is referred to as "mill residue." The term residue is somewhat misleading because currently much, but not all, of the mill residue material is used to produce products or as fuel.

1.2 The Sources of Mill Residue

Although mill residue is produced by all plants processing timber into primary wood products, over 95 percent of the mill residue generated in Montana comes from sawmills and plywood plants. The three types of wood fiber residue generated at sawmills and plywood plants are:

(1) Coarse or chippable residue consisting of slabs, edgings, and trim from lumber manufacturing, log ends from sawmills and plywood plants, pieces of veneer unsuitable for plywood manufacture, and peeler cores from plywood plants not sawn into lumber;

(2) Fine residue consisting of sawdust or planer shavings from sawmills and sander dust from plywood plants; and

(3) Bark from sawmills and plywood plants.

The other components of mill residue in the forest products industry include peelings and log ends from the post and pole industry, log ends, peelings, and sometimes slabs from the house log industry and cull material from cedar products producers. The volumes involved are small, however, and are not included in this analysis.

1.3 The Use of Mill Residue

The major current and projected uses of mill residue in Montana include the following:

(1) The pulp and paper industry. This sector uses coarse residue and some fine residue (sawdust) as raw material to manufacture paper. Fine residue and bark are also used as fuel.

(2) Reconstituted board plants. These plants include a particleboard plant and a fiberboard plant. The particleboard plant primarily uses fine residue (planer shavings) as a raw material, while the fiberboard plant uses both fine residue and coarse residue.

(3) Energy facilities. Included here are facilities generating electricity and those using mill residue as fuel not included in the other categories. They use primarily bark and fine residues.

(4) Sawmills and plywood plants. These plants use a portion of the fine residue and bark they generate in their own operations to dry lumber or veneer or to provide winter heat.

(5) Other uses. There are several other uses of wood residue in the state, including decorative bark, garden mulch, residential fuel wood, and animal bedding. The volumes involved are small, however, and are not included in this analysis.

1.4 Units of Measure

Mill residue is expressed in thousands of cunits. A cunit is 100 cubic feet of solid wood and approximately 2,500 pounds oven dry weight. The energy equivalent of 1 cunit of residue is approximately 21 million BTUs.

2. Preparing to Use the Program

2.1 System Requirements

Hardware

* IBM PC, PC/XT, PC/AT or IBM-compatible personal computer.
* Two floppy-disk drives or one floppy- and one hard-disk drive.
* 320KB RAM.

Software

* PC- or MS-DOS 3.1 or higher.
* The Montana Mill Residue Assessment and Simulation System distribution diskettes 1 and 2.

2.2 Installing the Program

Hard-Disk Installation

It is suggested that a subdirectory be created to hold the files contained on the distribution diskettes. The following instructions assume that your hard-disk is identified as disk drive C.

(a) Create a subdirectory called MAS with the following commands (each command line is ended by pressing the "Enter" key on the keyboard):

```
C:
CD\
MD MAS
```

(b) Insert distribution diskette 1 into drive A. Load the files onto subdirectory MAS of the hard-disk by entering:

```
COPY A:*.* C:\MAS
```

(c) Insert distribution diskette 2 into drive A. Repeat the command in step (b) above.

Floppy-Disk Installation

No specific installation procedure is needed when using the program on a floppy-disk system.

3. Using the Program

3.1 Getting Started

On a Hard-Disk System

Make sure the C> prompt is on the screen. Enter the following commands to start the program (again, each command line is ended by pressing the "Enter" key on the keyboard):

```
C:
CD\MAS
MAS
```

On a Floppy-Disk System

Insert distribution diskette 1 into drive A and distribution diskette 2 into drive B. Make sure the A> prompt is on the screen. Enter the following commands to start the program:

```
A:
AMAS
```

3.2 Program Structure

The operation of the program is menu driven. A menu is, in essence, a list of possible tasks to be performed. Each item on a menu is designated by an alphanumeric label. The execution of any particular task is carried out by entering the appropriate label on the keyboard. Once the program is started, the following menu will appear on the monitor:

Figure 1
Main Menu

H. Help
I. Supply-Demand Assumptions
J. Mill Residue Generated
K. Supply-Demand Balance
L. Print Report
X. Exit

Menu item (H), *Help*, for example, provides on-line assistance for using the program. Menu item (X), *Exit*, on the other hand, instructs the program to quit running.

In some cases, the selection of a menu item may invoke a secondary menu, or submenu, if additional instructions from the user are required to complete the task. Upon completion of the submenu options, the program will always return to the previous menu from which the submenu is called. The menu-submenu hierarchy is illustrated in section 3.4. Similar structure is maintained consistently throughout the program.

3.3 Mill Residue Analysis

Menu item (I), *Supply-Demand Assumptions*, is the pivotal step in the analysis of mill residue. It allows a user to change the various assumptions related to mill residue supply and demand. The task of defining the assumptions is achieved through a submenu, which will be discussed in section 3.4. It should be noted that the program is initiated with a set of default assumptions, which will remain effective until changes are made via menu item (I). Any changes that are made will remain effective until instructions for revision are received from the user.

Based on the current set of supply-demand assumptions specified in menu item (I), mill residue supply and the supply-demand balance are determined and shown, respectively, in menu item (J), *Mill Residue Generated*, and (K), *Supply-Demand Balance*. Section 4 presents a detailed discussion of these two menu items.

Finally, menu item (L), *Print Report*, generates a report on the printer which summarizes the simulation results of menu items (J) and (K), as well as the underlying supply-demand assumptions of menu item (I).

While menu items (J), (K), and (L) suggest a logical sequence in deriving the simulation results, they need not be activated in that particular order. The selection of menu item (K) for the supply-demand balance, for example, is not conditional on the execution of menu item (J); the program will determine

automatically all supply and demand information needed for completing this particular task. Similarly, a user can obtain the summary report via menu item (L) without first going through menu items (J) or (K).

3.4 Supply-Demand Assumptions

Upon selecting menu item (I), a user will be presented a submenu which consists of two panels: one lists assumptions related to mill residue supply, and the other lists assumptions related to mill residue demand (see figure 2).

Figure 2
Submenu: Supply-Demand Assumptions

Supply Assumptions

A. Lumber Production
B. Plywood Production
C. Residue Factors
D. Review Supply Assumptions

Demand Assumptions

E. Product Use
F. Hog Fuel Use
G. Review Demand Assumptions

X. Exit

Supply Assumptions

Mill residue generated is derived by applying residue factors to the volume of lumber and plywood production. Each one of these three determinants of mill residue generated (i.e., lumber production, plywood production, and residue factors) can be varied by the user via menu items (A), (B), and (C).

In menu item (A), *Lumber Production*, historic lumber production in Montana is available for counties or county groups defined as follows:

Beaverhead Area - Beaverhead, Gallatin, Madison, Park

Broadwater Area - Broadwater, Fergus, Jefferson, Judith Basin, Lewis & Clark, Meagher, Teton, Wheatland

Carbon Area	- Carbon, Musselshell, Powder River, Rosebud, Stillwater
Flathead County	- Flathead
Granite Area	- Granite, Powell, Ravalli
Lake Area	- Lake, Mineral, Sanders
Lincoln County	- Lincoln
Missoula County	- Missoula

If no other level of lumber production is specified, the program uses the most current 1986 data for the calculation of mill residue generated. Alternatively, a user can select a specific year's production figure displayed on the monitor or enter other estimates of lumber production.

In menu item (B), *Plywood Production*, historic plywood production data are available statewide. A user has the option of using the most current 1986 data (i.e., the default), specifying a specific year, or entering other estimates of plywood production.

The 1986 lumber and plywood production data used in the program are preliminary. The source for the revised lumber production data is the *Statistical Yearbook of the Western Lumber Industry*, Western Wood Products Association, Portland, Oregon. The updated plywood production data can be obtained from the American Plywood Association in Tacoma, Washington.

The program allows a user to enter actual lumber and plywood production through 1988. Nineteen eighty-seven and 1988 data can be entered permanently in the data base file named MAS.DBF using dBase III.

Residue factors are statewide averages by type, based on a survey of Montana's industry conducted by the University of Montana, Bureau of Business and Economic Research. They are displayed in menu item (C), *Residue Factors*, and can also be varied by the user. The default residue factors are shown in table 1. The residue factors show the volume of residue generated per thousand board feet (MBF), lumber tally, or per thousand square feet of plywood (MSF), 3/8 inch basis.

Table 1
Residue Factors

	Sawmill (Cunits/MBF)	Plywood (Cunits/MSF)
Coarse	0.53	0.28
Sawdust	0.23	
Sander dust		0.02
Planer shavings	0.21	
Bark	0.22	0.12
Total	1.19	0.42

Menu item (D), *Review Supply Assumptions*, provides a summary of the current set of assumptions that forms the basis for deriving mill residue supply.

Also included in the output, as a constant, are the estimated mill residue volumes available statewide from other producers.

Demand Assumptions

Mill residue can either be used as a raw material for wood and paper products, or as fuel in the form of hog fuel, both internally by the sawmills and plywood plants to dry products and produce winter heat, and externally by other facilities.

In menu item (E), *Product Use*, a user can specify various levels of product use to examine its effect on the mill residue supply-demand balance. The default demand for mill residue products is based on the indicated normal operating levels of the pulp and paper and reconstituted board plants using residue from Montana. Historic use of Montana mill residue by out-of-state plants is also included. The below normal level decreases total use of all residue types for products by 15 percent. The above-normal level increases total use by 15 percent. This increase would represent the consumption of an additional reconstituted board plant or a small pulp mill.

The rate of internal hog fuel use, which is directly related to lumber and plywood production, is determined within the program.

Menu item (F), *Hog Fuel Use*, allows a user to change the level of external hog fuel use by major purchasers of fine residue and bark used for fuel. Four levels are indicated: The default or normal level is based on the stated needs of the current purchasers of hog fuel from Montana mills. The below-normal level reduces this level by 150 thousand cunits annually. This is equivalent to what might happen if dramatic declines in natural gas and fuel oil prices took place. The above-normal level increases demand by 150

thousand cunits. This would supply a 25 to 30 megawatt power plant. The high level is 300 thousand cunits above the normal level. This is a volume sufficient to supply a 50 to 60 megawatt power plant.

Menu item (G), *Review Demand Assumptions*, provides a summary of the current set of assumptions that forms the basis for deriving the mill residue supply-demand balance.

By selecting menu item (X), *Exit*, the supply-demand assumptions submenu will be closed. It should be noted that, in a submenu, the exit command will simply instruct the program to return to the previous menu from which the submenu is called. The program will stop running only when the exit command in the main menu (see figure 1) is executed.

4. Simulation Result

Given the supply-demand assumptions discussed in section 3.4, the program automatically determines the volume of mill residue generated and the supply-demand balance in Montana, which can be viewed via menu items (J) and (K), respectively. The simulation results presented in the next two sections are based on the default assumptions related to mill residue supply and demand. They illustrate mill residue availability for 1986.

4.1 Mill Residue Generated

As noted earlier, part of the mill residue generated is used internally by the sawmills and plywood plants as hog fuel. The rate of internal hog fuel use varies directly with the rate of lumber and plywood production. Menu item (J) displays the supply of mill residue, both by type and by supply source, in two tables. Table 2 shows the volume of mill residue generated before internal fuel use. Table 3, on the other hand, shows the volume of mill residue that is available for product and external hog fuel use.

The assumption is that the mill would use its lowest value residue--bark and sander dust--for its internal use and try to market the remaining material. For sawmills, sawdust and planer shavings would be used, in that order, if the volume of bark generated is not sufficient to meet internal demand. (In reality, if no outlet exists for sawdust and planer shavings, a portion of these would be used as fuel internally, regardless of the bark volume available.)

Table 2
Mill Residue Generated before Internal Hog Fuel Use
Selected Montana Counties and County Groups, 1986
(In Thousands of Cunits)

	Coarse	Sawdust	Sander Dust	Planer Shavings	Bark	Total[2]
From lumber production[1]	828	359	0	328	343	1,859
Beaverhead Area	113	49	0	44	47	254
Broadwater Area	51	22	0	20	21	115
Carbon Area	3	1	0	1	1	7
Flathead County	166	72	0	65	69	373
Granite Area	97	42	0	38	40	218
Lake Area	103	44	0	40	42	232
Lincoln County	158	68	0	62	65	355
Missoula County	134	58	0	53	55	302
From plywood production[1]	187	0	13	0	80	281
Total[2]	1,016	359	13	328	424	2,141

[1]Statewide total production.

[2]Details for the rows and columns may not add to the total due to rounding in the computer program.

Table 3
Mill Residue Generated after Internal Hog Fuel Use
Selected Montana Counties and County Groups, 1986
(In Thousands of Cunits)

	Coarse	Sawdust	Sander Dust	Planer Shavings	Bark	Total[2]
From lumber production[1]	828	359	0	328	143	1,659
Beaverhead Area	113	49	0	44	19	227
Broadwater Area	51	22	0	20	8	103
Carbon Area	3	1	0	1	0	6
Flathead County	166	72	0	65	28	333
Granite Area	97	42	0	38	16	195
Lake Area	103	44	0	40	17	207
Lincoln County	158	68	0	62	27	317
Missoula County	134	58	0	53	23	269
From plywood production[1]	187	0	0	0	26	214
Total	1,016359		0	328	170	1,874

[1]Statewide total production.

[2]Details for the rows and columns may not add to the total due to rounding in the computer program.

The volumes of coarse residue, sawdust, planer shavings, and bark available from other sources are not reflected in the corresponding column totals of tables 1 and 2. The annual statewide estimates measured in thousands of cunits are: coarse 20; sawdust 10; planer shavings 10; and bark 20. Small quantities of this material are currently used; however, the majority remains unused.

4.2 Supply-Demand Balance

Consumption of coarse residue by Montana users plus historic levels of out-of-state use of Montana coarse residue should exceed 1,100 cunits. Demand in and out of Montana should be sufficient to utilize virtually all of the coarse residue available, even in years of relatively high lumber and plywood production.

A new large facility requiring coarse residue would have to compete directly with existing users. The supply-demand balance, therefore, focuses on fine residue (sawdust, sander dust, and planer shavings) and bark.

The users should be aware that the program will allow them to make assumptions that would indicate large volumes of unutilized coarse residue; however, at present these assumptions would be very unrealistic.

Menu item (K) provides a summary of mill residue supply and demand in Montana for fine residue and bark. In table 4's total column, the first number is the volume of mill residue generated from lumber and plywood production, which is equal to the totals in table 2 for sawdust, sander dust, planer shavings, and bark. The third number is the volume generated adjusted for internal hog fuel use. It represents the total supply available for product or external hog fuel uses, and is equal to the corresponding totals in table 3.

The fourth number in this column is the aggregated market demand for these four mill residue types; it is the sum of product use and external hog fuel use. The level of this aggregated demand, of course, depends on the various demand assumptions defined in menu items (E) and (F), which are discussed in section 3.4.

By consolidating mill residue supply and market demand conditions, the last number shows the balance of fine residue and bark in Montana. A positive balance means supply exceeds demand, leaving a surplus. A negative balance, as in the case of table 4, indicates a deficit as a result of supply falling short of demand.

Table 4
Supply-Demand Balance, Sawdust, Sander Dust, Planer Shavings, and Bark
Montana, 1986
(In Thousands of Cunits)

		Total[1]
Fine residue and bark generated		
From lumber production	1,031	
From plywood production	93	1,125
Less: Internal hog fuel use		267
		858
Demand for fine residue and bark		
Product use	414	
External hog fuel use	240	654
Balance		204

[1]Detail for the rows and columns may not add to the total due to rounding in the computer program.

Table 5 displays supply, shipments, and unutilized volumes by type of mill residue by county or county group. It begins with the volume of mill residue generated, adjusted for internal hog fuel use. The second row shows the volume of mill residue shipments, which is derived from a simulation algorithm which takes into account (1) the historic mix of mill residue used as inputs for products and hog fuel, (2) the volume and the component of mill residue generated, and (3) the location of the mill residue supply.

The third row indicates unutilized mill residue volumes by type. It is the difference between the volume of mill residue after internal hog fuel use and the simulated volume of shipments to other users. Finally, the remainder of the table provides a breakdown of mill residue inventory by type and by county or county group in Montana. Its derivation is, of course, related to the algorithm used in the simulation of mill residue shipments. The program assumes that mill residue users will acquire the material in increments based exclusively on haul distance. Although this is generally the purchasing strategy, it is not followed absolutely. Table 5 should be used to identify large concentrations of mill residue but not necessarily to exclude potential sources of supply.

Note: a zero in a given area does not mean all residue in that county or group of counties is committed to use. It means that if residue were selected strictly on the basis of proximity to the facilities using residues, then all residue in the areas showing zero would be utilized.

Table 5
Supply-Demand Balance, by Type of Mill Residue
Selected Montana Counties and County Groups, 1986
(In Thousands of Cunits)

	Sawdust	Sander Dust	Planer Shavings	Bark	Total[3]
Fine mill residue and bark generated (after internal use)[1]	359	0	328	170	858
Shipments[2]	268	0	291	91	651
Unutilized residue[1]	91	0	36	78	206
Beaverhead Area	49	0	14	19	83
Broadwater Area	22	0	20	8	51
Carbon Area	1	0	1	0	3
Flathead County	9	0	0	27	36
Granite Area	0	0	0	0	0
Lake Area	0	0	0	0	0
Lincoln County	9	0	0	22	31
Missoula County	0	0	0	0	0

[1]Statewide total production.

[2]Statewide total shipments to mills in Montana and in other states.

[3]Detail for the rows and columns may not add to the total due to rounding in the computer program.